THE DENTAL PRACTITIONER

AND DENTAL RECORD

Including the official reports of the British Society of Periodontology, the British Society for the Study of Orthodontics, the European Orthodontic Society, the Glasgow Odontological Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis

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THE DENTAL PRACTITIONER
AND DENTAL RECORD

Vol. VIII, *No.* 1 — *September*, 1957

CONTENTS

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SMITH, J. A. K. (1949), *Brit. dent. J.*, **86**, 271.

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THE DENTAL PRACTITIONER
AND DENTAL RECORD

Vol. VIII, No. 1 September, 1957

EDITORIAL

EIGHTH EDITION

THIS number of the journal commences the eighth volume of THE DENTAL PRACTITIONER. Turning back through the pages of seven years' work we can trace the changes in format and substance of the journal. It might be suggested by some that these changes have not altogether been for the good, but we sincerely trust that they have. We realize only too well that the nature of the journal and the type of article published in its pages may not appeal to everyone. Basically this is still a journal for the dental surgeon in general practice, and a major criticism levelled at us is that we do not give sufficient space to his individual needs. The answer to this is, that we, like every other journal, can only publish articles that are submitted to us. Many articles of practical import are commissioned by us but it is not always easy to persuade potential authors to write such articles. Our policy is to try to balance each number every month. If we were to produce a purely practical number of the journal and fill it with articles on the everyday needs of the practitioner we should soon run out of material, and the following four or five issues would be of very limited interest, appealing to the academic world only. We attempt as far as possible to include in each number something of interest to each section of dentistry.

An additional important fact is that it is a duty of a journal to present material that will stimulate interest in the wider field of dentistry as a public health service. The scope of a modern dental surgeon should not be limited to fillings and extraction of teeth, and neither should his reading. It is only right that we should produce articles on the mechanical aspect of our work, but it is just as important to include articles on the biological aspects as well. Behind the tooth there is always a human being and the tooth is part of his living tissue. A change in this tissue may be a reflection of the general health of the patient and it is the duty of the dental surgeon to diagnose and advise although not necessarily to treat. Recognition and advice on prevention are equally as important as a high standard of restorative treatment.

We are, as always, open to advice and suggestions from our readers and we trust that the journal will still appeal to all practitioners and that in each issue every reader will find something of value for the benefit of his practice and his patients.

1

IMPLANT MATERIALS AND THE GINGIVAL TROUGH

By **BORIS TRAININ**, L.D.S. R.C.S.
Chairman of the Dental Implant Society of Great Britain

EARLY attempts at implantation failed for the following reasons: lack of understanding of the physical and biological processes of the body; infection and the absence of antibiotics; incorrect design and the use of unsuitable materials.

ELECTROCHEMICAL ACTION

It is of vital importance that the material from which dental implants are made should be chemically and electrolytically inert. When embedded in the body, certain metals, or combinations of metals, have an appreciable electrolytic action (Venable and Stuck, 1947). In other words, a difference of electrical potential is set up between the metal or metals and the hard and soft tissues, the body fluids acting as an electrolyte. The galvanic current so produced causes disintegration and corrosion of the metal, and migration of metallic particles which irritate or poison the surrounding cells (Key, 1946). As a result the implant becomes loose and is ultimately rejected, and it is for this reason that gold, silver, and many other metals and their alloys are contra-indicated (Bothe, Beaton and Davenport, 1940; Trainin 1957 a).

PHYSICAL PROPERTIES AND COMPOSITION

The criteria of a successful implant material can be summarized as follows:—

1. Insoluble in body fluids.
2. Non-cytotoxic.
3. Non-carcinogenic.
4. Adequate hardness, toughness, stiffness, and ductility to withstand, for a lifetime, the forces imposed upon it (when used in thin sections), without fragmenting, cracking, distorting, breaking, or wearing away.
5. Readily cast or worked to the required form, without losing its essential properties.
6. Resistant to stress-corrosion or fretting under load *in vivo*.
7. Radio-opaque.

Certain chrome-cobalt alloys appear to fulfil these requirements. Basically, chrome-cobalt alloys are solutions of chromium, cobalt, and molybdenum with small additions of other elements, including silicon, manganese, and carbon (Osborne and Lammie, quoting Trainin, 1953). They are work-hardening so they cannot be machined, but they can be accurately cast to any desired form, and can also be ground and highly polished.

It is widely supposed that all chrome-cobalt alloys are similar. On the contrary, these alloys vary considerably in composition and characteristics, and in their reaction to the tissues (Trainin, 1946). Certain chrome-cobalt alloys contain *beryllium*, which is cytotoxic even in minute proportions. The author has personally observed three cases in which implant failure has been directly due to the use of a chrome-cobalt alloy containing beryllium. Clearly, then, it is important to use only those alloys of known composition which have passed the most stringent clinical and laboratory tests and have proved wholly suitable for implant work. Marziani (1954) condemns the use of all alloys, but extols the virtues of tantalum, for which he claims "hormone-like qualities". There appears to be little scientific basis for his assertions. Moreover, the physical properties of tantalum are not impressive: for instance, annealed tantalum has an elongation of 40 per cent, which is too ductile for use in dental implants. In the hardened state, tantalum has an elongation of only 2 per cent, far too brittle for successful use; mechanical trauma would involve considerable risk of implant fracture.

In this context, Jermyn (1955), in a personal communication to the author, writes: "... there are also cases existing in the States where patients wearing chrome-cobalt implants have suffered facial injuries and mandible fractures from automobile accidents. The chrome-cobalt alloy implant has remained intact and

has actually acted as a splint for the fractured mandible. Had the implant been made of tantalum . . . it would have added to the injuries."

Whilst Marziani's claims for tantalum do not in any way invalidate the statistics for the successful use of chrome-cobalt alloys for implants, it is nevertheless worth recording that Marziani claims 100 per cent success with his implants. His technique is brilliant and unique.

In the United States, where it is estimated that well over a thousand implant dentures are currently in use, most have been made of Vitallium, a chrome-cobalt alloy which is a product of the Austenal Company of America. This Company has done much to further the knowledge of implant dentistry.

Since 1945 the author has been closely concerned in the research and development of a British chrome-cobalt alloy—Virilium. Of the twenty-two dental implants he has designed and fitted, all have utilized this material, which is particularly well tolerated by the tissues.

In 1951 solubility tests with Virilium were carried out by the Blood Research Group of the Lister Institute. Samples of the metal were weighed in grammes to the fourth decimal point and were separately immersed in:—

i. 1 per cent lactic acid.
ii. Human serum.
iii. Red cells in saline.

These solutions were incubated at body temperature and shaken every five days. After sixty days (double the time prescribed for such tests by the American College of Surgeons, 1944–5), the samples were dried and weighed again. No loss of weight was observed in any of the Virilium specimens tested.

Electrolytic tests (Clarke and Hickman, 1953) show Virilium to have an anodic back E.M.F. of +750 millivolts—a degree of electrical inertia considered to be highly satisfactory. The physical properties of Virilium are:—

Hardness (Brinell)	291
Elongation	10 per cent
Ultimate tensile strength	110,000 lb. per sq. in.
Modulus of elasticity	18,000,000
Specific gravity	7·8
Melting point	1280° C.

Mack (1954) writes: "There is some risk of the physical and chemical characteristics of alloys becoming altered if the metal is melted by oxy-acetylene. High frequency induction melting is the method of choice."

This assertion is true only if the physical and chemical characteristics are obtained from induction-melted castings. With Virilium, all chemical and laboratory tests have been conducted on castings melted by oxy-acetylene, and this may well be true of other chrome-cobalt alloys. The author has made over a thousand chrome-cobalt castings using oxy-acetylene, and has no fault to find with this method of melting.

THE IMPLANT GINGIVAL TROUGH

By far the most frequent criticism of dental implants, by those who are unfamiliar with them, is that infection will occur at the site of the abutment and will eventually cause osteomyelitis. Yet no case of osteomyelitis has been reported among the fifteen hundred or more implants that have so far been inserted. Indeed, histological and clinical evidence shows that "there is usually less sign of inflammatory cells round an implant abutment than around many healthy natural teeth" (Bodine, 1954 a, b).

Histological studies of the tissues adjacent to the implant posts in both dogs and man have been carried out by several workers. Herschfus (1955), in his third report on implants in dogs, writes: "Immediately adjacent to the abutment, the stratified squamous epithelium of the gingival margin dipped slightly downward. The epithelium itself was slightly keratotic, quiescent and without significant histopathological changes. Hyperkeratosis, parakeratosis and acanthosis were not observed. In an occasional section, the termination of the squamous epithelium was followed by a thin zone of granulation tissue, containing a scant infiltration of lymphocytes and plasma cells. As indicated above, no evidence of a distinct pocket was found between the gingival tissue and the posts of the implants. The corium adjacent to the implant was composed of dense collagenous connective matrix with minimal vascularity

and a paucity of chronic inflammatory cells. Complete absence of the latter was commonly noted."

Weinmann* (1956), seeking the answer to the question, "What mechanism prevents the invasion of bacteria along the abutment posts?", first reviews the origin and mechanism of the gingival attachment to the enamel of the tooth. Gottlieb's (1926) views on the epithelial attachment, which have been accepted without question for so long, have been seriously challenged by the research of Waerhaug (1956) and Orban (1956). No longer do we believe that the remnants of the epithelium which formed the enamel become fused with the oral epithelium when the tooth erupts. We believe a secondary attachment replaces the first. This hornified attachment "may be similar to the way in which various species of insects attach themselves to different materials by secreting and exuding a binding substance". This leads to the hypothesis that the same process of attachment might be possible if inert metal were substituted for enamel.

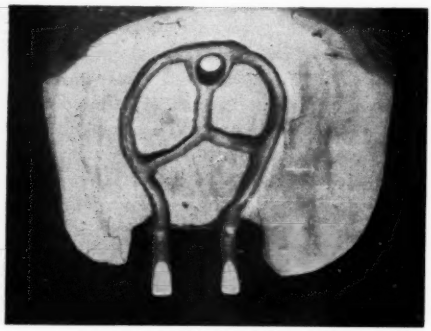

Fig. 1.—Palatal surface.

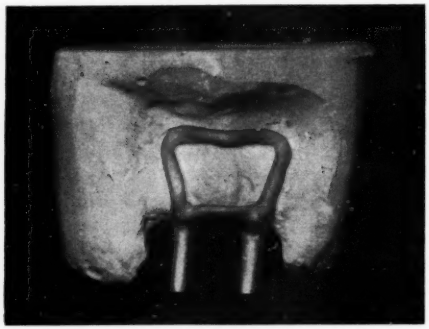

Fig. 2.—Labial surface.

We are all familiar with the clinical phenomenon of re-attachment of the epithelium; after any flap operation involving the gingival margin, or after deep scaling and curettage of a pyorrhœa pocket, re-attachment of the epithelium usually takes place. If a tooth over-erupts because of abrasion of the occlusal surface, or because of the loss of an occluding tooth, the epithelium becomes attached to the exposed cementum. Although no histological evidence is yet available to show that this is what happens at the implant gingival trough, it is at least possible that the epithelium also attaches itself to the neck of the abutment in a similar way.

Those research workers who have been capable of making clinically successful implants have invariably found a normal healthy gingival crevice, lined about one-third of the way down with epithelium, and similar in most respects to the gingival trough of a natural tooth. Adaptation of the tissue to the abutment is extremely close, and no possibility of leakage seems to exist.

On the other hand, those whose implants have failed *clinically* have naturally found pathological changes present. For instance, the only conclusion to be drawn from the negative findings of Nichols (1954) is that he had not fully mastered the technique of making successful implants in dogs. Describing his implants, Nichols writes: "The alveolar mucosa did not heal over any of the screws. . . . In two implants, the overlying mucosa retracted, exposing almost half the entire framework. . . . None of the implants was clinically successful longer than four and a half months." Despite the striking successes of other workers in this field, Nichols, basing his pathological findings on the foregoing results, concludes: "The principle of semi-buried implants appears to be untenable."

Almost without exception, the failure of implants can be attributed to the unwise

* Professor of Oral Pathology, University of Illinois.

choice of patients, incorrect design and technique, or to the use of unsuitable materials. It is significant, too, that many of the failures recorded were the surgeons' first or second attempts at implantation.

Fig. 3.—Implant being fitted. Lower part of the picture shows palatal periosteum.

Unsuccessful implants are not always difficult to remove, as they may already be loose and resting on soft tissue. One of the author's early cases, replacing $\underline{765}|$, had part of the buccal grid exposed for two years. Several attempts to remove the epithelium from beneath the implant, and to form a protective flap, were unsuccessful. At no time was any infection present, nor did the patient suffer pain. The implant was eventually taken out as it became increasingly unstable and subsequent healing was rapid and uneventful. To date, this is the author's only failure.

In a previous paper (1957 b) the author mentioned that great care was necessary to avoid piercing the lateral wall of the nasal septum if a screw was used to secure a maxillary implant. He wrote: "Should this occur, infection is liable to track down the screw and give rise to a palatal abscess, endangering the implant and necessitating early removal of the screw." The following case illustrates this point.

CASE REPORT

Female, 34 years, $1|\underline{14}$ missing. An acrylic denture, extending to the distal walls of $\underline{5}|\underline{5}$ was causing distress. Gingivitis was present to a marked degree, and there was pocketing in the areas covered by the denture. For a variety of reasons a fixed bridge or metal denture was contra-indicated. It was decided to make a subperiosteal implant, to which $\underline{1}|\underline{1}$ could be permanently cemented as jacket-crowns. The direct method was employed, and the implant was fitted with one screw in the midpalatal line (*Figs.* 1–5). Two holes were drilled in the old upper denture to receive the posts, and the denture was inserted in order to prevent a hæmatoma of the palate.

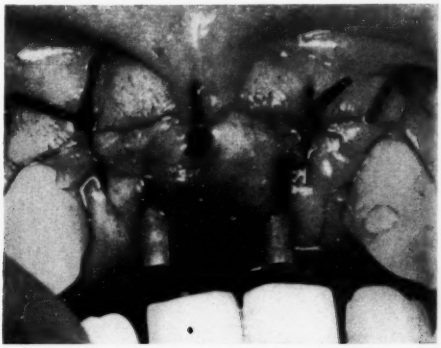

Fig. 4.—Immediately after suturing.

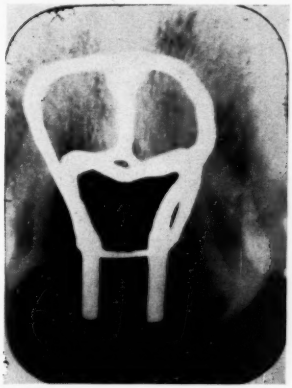

Fig. 5.—X-ray of implant showing screw in position.

The patient was seen regularly and healing progressed satisfactorily until the seventh day, when a swelling in the midpalatal line was noticed. On compression, pus exuded from the gingival margin around the posts (*Fig.* 6).

Penicillin was injected parenterally and a cruciform incision made over the swelling. Although the wound was irrigated daily and the patient was kept under a penicillin umbrella, suppuration continued. An antibiotic sensitivity test indicated that the organisms were insensitive to penicillin, and chloromycetin (250 mg. 6-hourly for 4 days) was then prescribed, followed by aureomycin (250 mg. every 4 hours for a further 3 days), and tablets of vitamin B complex were given throughout this period. Suppuration ceased on the seventh day of treatment, but the sinus remained patent. It was decided to remove the screw, which proved to be loose, and the

sinus then healed within 24 hours. At this time the gum in the region of the posts was pink and healthy (*Fig.* 7) and the artificial teeth were then cemented in place. After nearly two years the prosthesis remains æsthetically and functionally successful (*Figs.* 8, 9), and the pre-operative palatal gingivitis and pocketing have been eradicated.

Fig. 6.—Inflammation around posts. The arrow points to sinus.

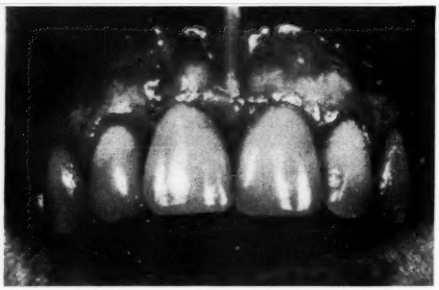

Fig. 8.—Jacket-crowns in place, after 18 months.

In the author's opinion, dental implants will never supersede conventional dentures, but they may well prove to be the best, if not the *only* solution in exceptional cases. Since successful implants have been in place for only nine years, each new case must be approached with considerable caution and carefully assessed on its individual merits. It is a *sine qua non* that implantation should not be contemplated if conventional dentures offer reasonable prospects of success. On the other hand, there are many patients to-day who are happy and confident with their implant dentures and who were formerly miserable and distressed with a conventional prosthesis.

SUMMARY

The physical and electrochemical properties of implant materials are described.

Contemporary views on the histology of the implant trough are discussed.

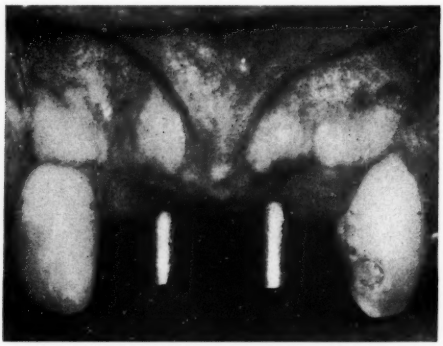

Fig. 7.—Tissue healthy and ready for jacket-crowns, 3 weeks after insertion.

Fig. 9.—X-ray showing empty screw hole and healthy bone. Metal diaphragm and lugs of crowns, 20 months.

A case is described showing that tissue repair after infection of a subperiosteal dental implant may be rapid and complete.

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BOOK REVIEWS

PHANTOMKURS DER KONSERVIERENDEN ZAHNHEILKUNDE. Ein Leitfaden. By Prof. Dr. C. H. RATHNER, Halle. $9\frac{1}{2} \times 6\frac{5}{8}$ in. Pp. 94, with 156 illustrations. 1956. Leipzig: Georg Thieme. Bound, D.M.13.25.

THIS book is a short primer of operative dentistry with emphasis on phantom-head procedure. It deals with instruments, cavity preparation, and the properties and use of the various filling materials, including metal and porcelain inlays.

Then follows an introduction to root canal therapy and an appendix on the maintenance of straight and contra-angle handpieces.

E. R.

PEDIATRIC DENTISTRY. By M. MICHAEL COHEN, D.M.D. Stomatologist, Boston Floating Hospital; Lecturer, Pediatric Stomatology, Tufts University School of Medicine, Department of Pediatrics; Lecturer, Pediatric Stomatology, Tufts University School of Dental Medicine. $10 \times 6\frac{3}{4}$ in. Pp. 607, with 395 illustrations, 9 in colour. 1957. London: Henry Kimpton. 110s.

THIS six-hundred-page book which has been edited by Dr. Cohen, and written together with sixteen collaborators, is a very useful supplement to the literature on children's dentistry. However, by attempting to cover so wide a range of subject matter related to pædiatric dentistry, it is unfortunately caught between two stools and can be termed neither a text-book nor a true reference book. Its shortcomings as a text-book are underlined by the fact that only 45 pages are used to cover the entire field of practical pædiatric dentistry, i.e., examination, routine radiology, treatment planning, conservative technique, anæsthesia, fractured incisors, and endodontics. It would seem, therefore, that chapters such as the one on The Embryological Development of the Head, Face and Oral Cavity, could well have been left out, as the subject is dealt with more fully by that author and others in text-books on embryology. This criticism could also be applied to the chapter on The Development and Growth of the Jaws. The chapter on The Anatomy of the Primary Teeth appears to perform no useful function, and could well be omitted. While feeling that the majority of the subject matter in this book is not covered in sufficient detail to merit place amongst the books of reference, this criticism is, to some extent, negatived by the fact that almost every chapter has a very full bibliography.

On the credit side, this book has very many good features. The chapter on The Physical Growth and Development of the Child, when linked with the one on The Psychological Development of a Child, forms a very valuable basis for the practice of children's dentistry. The chapter on Nutrition and Oral Health is of fundamental importance and is clearly written. The section on The Handicapped Child is a valuable contribution and contains many helpful suggestions, while the chapters on Oral Surgical Problems in Childhood, Oral Manifestations of Systemic Disease, The Endocrine Glands in Development, and Prophylactic Orthodontics are well written and clearly illustrated. While this book cannot be considered a 'must' for the English student of pædiatric dentistry, there are many parts of the book which he would be well advised to read.

T. G. H. D.

A COMPARISON OF COBALT-CHROMIUM ALLOYS AND YELLOW AND WHITE GOLD ALLOYS*

By **W. JOHNSON**, M.Sc., L.D.S.
Department of Prosthetics, Turner Dental School, University of Manchester

My contribution to this Symposium on the dental cobalt-chromium alloys will be to review the comparative properties of cobalt-chromium alloys and yellow and white golds, with particular emphasis on the yellow and white golds. My interest in this field began several years ago at the time when yellow gold alloys were in short supply, and one had to try to find an acceptable substitute. Cobalt-chromium alloys were at that time only in their infancy, in this country at any rate, and our main alternative material was white gold. Let me make it clear at this stage that by "white golds" I am referring to that group of alloys which have palladium and silver as chief constituents, and not to alloys of high gold content which are white due to the presence of a high platinum or palladium content or the presence of nickel. These white golds were introduced in the 1930s, largely, it is suspected, to find an extra market for the metal palladium which was being produced in increasing quantities, but for which there was little demand.

There had been a number of reports that the incidence of fracture of white gold dentures in service was greater than that found with yellow gold dentures. They were unpopular with technicians because the incidence of failure to cast completely was high. One was then left asking just how adequate were the white gold alloys as denture base materials. In order to try to throw some light on this problem an investigation was made of the tensile properties of three representative white alloys. In order to be able to use the determined properties to assess the alloys, it was necessary to have some level of properties above which a material could be considered satisfactory, and below which it must be considered unsatisfactory. A search of the literature suggested that no such level had been decided on. There is no American Dental Association specification for denture casting alloys, but there is a Federal specification. Amongst other requirements this demands for a hardened yellow gold alloy a minimum elastic limit of 65,000 lb./sq. in., a minimum ultimate tensile strength of 90,000 lb./sq. in., and a minimum percentage elongation of 2 per cent. It was felt that perhaps a better level would be obtained by testing a number of British yellow gold alloys under the same conditions as those used for the white golds and obtaining an average of their properties. Accordingly tests were made on 4 representative yellow alloys.

The tensile properties were determined by using the Hounsfield Tensometer Type C, a small universal testing machine with a load capacity of 2 tons. The construction of the machine is such that a graph can be plotted during a test showing extension of the specimen as a function of the load. Because of the machine characteristics, this is not a stress–strain curve, but it does allow one to determine from the graph the limit of proportionality and ultimate tensile strength. The elongation per cent is determined by using a special gauge designed for use with Tensometer specimens. The test specimens were cast to the No. 12 Tensometer Test piece size, a bar of circular cross-section with enlarged ends for gripping. The diameter of the gauge length is 0·178 in. and the gauge length 0·632 in.

As regards the production of the test specimens an attempt was made to keep as closely as possible to established dental casting procedure. Wax patterns were made by pouring molten inlay wax into a two-part P.V.C. mould. The mould was made from a brass specimen turned oversize to an amount necessary to compensate for wax contraction which was found to be about 7 per cent.

* A paper read before the British Society for the Study of Prosthetic Dentistry, April, 1956.

Various other mould materials were tried but none was found to be as satisfactory as P.V.C. Each mould will make about 50 wax specimens before it needs replacement. Any slight flash present on the patterns was trimmed off and they were then polished with moist cotton wool, and sprued. Experiments were carried out to find the best way of sprueing with respect to reducing porosity in the specimens to a minimum. In all cases the maximum occurrence of porosity was found to be in the head of the specimen adjoining the sprue. To reduce porosity in the actual specimen to a minimum, a double-length head of specimen was used. (*Fig.* 1.)

Both Solbrig steam pressure casting and centrifugal casting were used in the investigation. The best sprueing method for each was found to be as shown in *Fig.* 2.

For investing, ordinary model grade plaster-bound investment was used in conjunction with a vacuum-investing technique using a simple apparatus of the type described by Ireland, the source of vacuum being a water pump.

After the investment had set wax was burned out by a two-stage heating process. Firstly the rings were heated to 250° C. over 3 hours in a low-temperature oven, and then

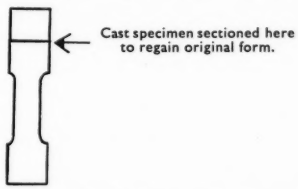

Fig. 1.—Method of reducing porosity in specimens in sprueing.

transferred to a high-temperature oven and heated to 700° in about a further 1½ hours. Casting was carried out using a Solbrig steam pressure press or a Kerr centrifugal casting machine operated in the usual way. The metal was melted by a gas-air flame using an S.S. White blowpipe. After casting, rings were left to cool for 10 minutes, and the specimens were then freed from the investment. The button, sprues, and added head were cut off with a fret-saw. No machining or other working of the specimens was carried out. Specimens were then given the requisite heat treatment, using the treatment recommended by the manufacturer of the gold alloy concerned, or in the absence of any definite instructions the treatment recommended by the U.S. Bureau of Standards was used.

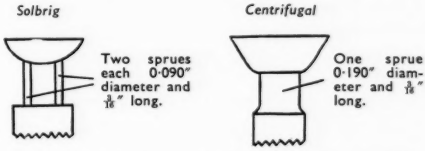

Fig. 2.—Illustrates the best sprueing method for Solbrig steam pressure casting and centrifugal casting.

Specimens were then pickled in dilute HCl, washed, and were then ready for testing.

RESULTS

First, a few general remarks before we consider the test values themselves.

1. Effect of Type of Casting Machine.—The casting machine used was found to have no observable effect on the properties of the yellow gold alloys tested. This was not the case, however, with white alloys, where centrifugal casting was found to give more consistent results. White gold specimens cast by the Solbrig method were found to have revealed occasionally in their fracture section a clean round cavity—a massive form of gas porosity possibly due to steam being trapped in the alloy. This porosity accounted for the poorer results found with this casting machine.

2. Remelting.—Tests were routinely made on new alloy and also on alloy melted and cast once and twice previously. No deterioration in properties was found to occur in either white or yellow alloys in remelting.

3. Specimen Size.—One question to be faced is, how far do the properties determined on specimens of Tensometer specimen size represent the properties of dental castings, the section of which is generally much thinner? Tests were made of internal structure—both the presence of porosity and the grain size—and response to heat treatment for a variety of specimen sizes from clasp thickness up to Tensometer specimen size. From the results

it was concluded that the properties of actual dental castings should be, if anything, superior to those of the Tensometer castings.

4. Consistency of Results.—This was on the whole very satisfactory, individual values being within the range ±10 per cent of the calculated average values except for elongation percentage. Values of elongation percentage are numerically so low compared with the other properties that a small variation in elongation percentage produces a big change in the percentage variation from the average value.

5. Manufacturers' Values.—A comparison of values determined in the present investigation with those given by the respective manufacturers showed, for yellow gold alloys, a general superiority in the determined values, especially as regards elongation percentage. A reversal of this state of affairs was found with white gold alloys where the determined properties were generally slightly inferior to those claimed by the manufacturer.

6. Heat Treatment.—All the yellow gold alloys tested showed a marked response to heat treatment. One alloy, for instance, shows the following change in properties when in the hard heat-treated state compared with the soft heat-treated state.

Table I.—Comparative Tensile Properties

Material		State	Proportional Limit P.S.I.	Ultimate Tensile Strength P.S.I.	Elongation Per Cent
Yellow gold alloy	Alloy 1	Softened	52,000	78,000	35
	Alloy 2		60,000	81,000	34
	Alloy 3		59,000	80,000	36
	Alloy 4		55,000	70,000	39
	Alloy 1	Hardened	97,000	121,000	10
	Alloy 2		105,000	123,000	6
	Alloy 3		103,000	122,000	11
	Alloy 4		110,000	123,000	8
White gold alloy	Alloy 5	Softened	55,000	72,000	8
	Alloy 6		55,000	65,000	8
	Alloy 7		54,000	69,000	7
Cobalt-chromium alloy	Alloy 8	As cast	95,000	119,000	4
	Alloy 9		88,000	108,000	3
	Alloy 10		76,000	101,000	9
	Alloy 11		69,000	102,000	12
	Alloy 12		81,000	120,000	8

Table II.—Average Tensile Properties

Material	State	Proportional Limit P.S.I.	Ultimate Tensile Strength P.S.I.	Elongation Per Cent
Yellow gold alloy	Softened	57,000	77,000	36
	Hardened	104,000	122,000	9
White gold alloy	Softened	55,000	69,000	8
Cobalt-chromium alloy	As cast	82,000	110,000	7

	Per cent
Limit of proportionality	Increase of 100
Ultimate tensile strength	Increase of 75
Elongation per cent	Decrease of 80

So much for a general consideration of the results of the investigation of yellow and white gold alloys. For comparison purposes, I am indebted to Mr. Earnshaw for providing values of the tensile properties of a number of cobalt-chromium alloys. The same testing method and specimen form were used, but the casting technique had, of course, to be modified. Here again an attempt was made to produce specimens in a manner closely following normal cobalt-chromium dental casting technique. The results obtained by averaging at least 6 tests on each alloy are presented in *Table I*. It can be seen that there is a general similarity of properties between the different alloys of any given material. *Table II* compares the calculated average values for the different materials. The most important points we can note from these tables are:—

1. The superiority of yellow gold alloys.

2. Cobalt-chromium alloys come a good second—they satisfy the previously mentioned requirements of the Federal specification.

3. White gold alloys are not considered to be satisfactory, especially due to their low limit of proportionality—the danger of distorting a denture, especially clasps, is great.

Now to go on to a comparative study of other properties of the alloys.

1. Modulus of Elasticity or Young's Modulus.—Young's modulus for cobalt-chromium alloys is approximately twice that for gold alloys—about 30×10^6 lb./sq. in. against $13–15 \times 10^6$ lb./sq. in. The practical implication of this lies in clasp design. One can use twice the degree of undercut with gold than with cobalt-chromium, and only get an equal force on the tooth when inserting and withdrawing the appliance. In terms of values, if one uses 10/1000 in. undercut for gold then only 5/1000 in. should be used for cobalt-chromium.

2. Hardness.—The indentation hardness of the white gold alloys in the softened state on the Brinell scale is about 150. For a yellow gold alloy in the softened state it is about 170, and hardened 260. This compares with values for cobalt-chromium alloys of 270–300 for the softer alloys and 300–350 for the harder alloys. The indentation hardness should not be confused with abrasion resistance; the two are not proportional. I have no actual figures for the abrasion resistance of the materials, but that of cobalt-chromium alloys is certainly much greater than that of yellow and white golds, and they resist scratching better. The high abrasion resistance makes the finishing of cobalt-chromium alloy castings a greater problem than in the case of the gold alloys, and one has to use special equipment such as a sand blaster, electropolisher, and high-speed polishing lathe.

3. Density.—The yellow gold alloys are approximately twice as dense as cobalt-chromium alloys—values of the order of 17 against 8·5. White golds come about midway with a value of about 12. The significance of the density factor depends on the use to which an alloy is to be put. Where low weight is important, as for the construction of an upper denture with poor retentive factors existing, cobalt-chromium alloy is best. In distinction, if one wishes to make, for instance, a heavy base plate for a full lower denture, yellow gold alloy is best.

4. Corrosion Resistance.—All the alloys are reasonably satisfactory in corrosion resistance, with cobalt-chromium alloys considered best, yellow gold alloys a close second, and white gold alloys last. White gold alloys do tend to tarnish when the oral hygiene is not all that it might be. Rhodium plating on white golds has been suggested as a way to avoid any corrosion problem with them.

5. Melting and Casting.—Yellow gold alloys are the easiest to melt. White gold alloys have a melting point generally about 100° C. above that of the yellow gold alloys. They are rather pasty in the molten state and do not spin in the manner yellow golds do. The white gold alloys are also more liable to absorb gases from the blowpipe flame and should not be kept molten any longer than is necessary.

The cobalt-chromium alloys present a special problem because of their high melting point relative to the gold alloys, which brings them

outside the melting range of the ordinary gas-air blowpipe flame. Oxyacetylene melting is the commonest melting method for cobalt-chromium alloys but it has its problems because of the carburizing nature of the flame which can unbalance the alloy. High frequency induction heating is more satisfactory and is now being applied in Britain. Small arc furnaces have also been used in the United States.

6. Joining the Metals.—White and yellow gold alloys can be soldered satisfactorily. Cobalt-chromium alloys, however, present a problem similar to stainless steel, due to the chromium oxide coat on the metal. They can be soldered, but not as readily or as satisfactorily as gold alloys. Like stainless steel they can also be spot welded.

7. Price.—Last, but not least, one may mention price. White gold alloys cost less than half as much as yellow golds and so represent a considerable saving. The cobalt-chromium alloys are very much cheaper, but one has the problem of the cost of extra equipment involved, so from the economic point of view there is little to choose between a gold denture and a cobalt-chromium one.

In conclusion, I would request as many other views on the relative adequacy of the alloys as possible, in the course of the discussion to follow.

THE USE OF PLATE APPLIANCES IN THE TREATMENT OF PERIODONTAL TRAUMA*

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THE existence and importance of trauma as a factor in chronic periodontal disease is well recognized, but the evaluation of this phenomenon has been the subject of considerable difference in the opinions expressed by various investigators and clinicians. The group of those who deny the existence of periodontal trauma has lately disappeared, but there is still a majority which believes that periodontal trauma is not a primary but only a contributing factor in periodontal disease. This opinion, however, should be considered as only another transient stage which finally will lead to the recognition that trauma alone can be of such preponderance in the existence of some types of chronic periodontal disease that it really contributes a primary exciting factor in periodontal involvement.

There was even no agreement as to which term should be used to describe periodontal trauma. Traumatic occlusion, traumatogenic occlusion, trauma by occlusion, and other terms were used by different authors, according to their interpretation of this phenomenon. The Committee on Classification and Nomenclature of the American Academy of Periodontology has finally adopted the term "periodontal trauma", which this author has been using and recommending for many years, since it encompasses the entire physiopathological problem.

Periodontal trauma is the result of the lateral component of a force against the teeth, the effect of which exceeds the physiological resistance and adaptive capacity of the periodontal tissues. The injurious effects depend more on the frequency and the continuation of its intermittent action over a long period of time than on the magnitude of the force. This definition implies that force, tissue adaptability and resistance, as well as time, are the important factors. The masticatory apparatus is a functional organ and the periodontal tissues are subject to a certain load of force which may be called the normal functional load. On top of it a certain amount of an additional lateral force should be tolerated by the resistance of the periodontal tissues of an individual in average health. However, this constitutional resistance is a variable factor, not only in different individuals but also in the same

* A paper delivered to the American Dental Society of Europe, July 13, 1955.

individual. That accounts for the fact that the reaction to similar forces varies in different individuals or in the same individuals at different times.

Periodontal trauma, therefore, derives from an increase of the load of lateral force and may be aggravated by a lowered constitutional resistance which in extreme cases can reach the point where the normal functional load becomes a traumatizing quantity.

It is the lateral component of force only which is capable of producing periodontal damage since the vertical force is stimulating and necessary for periodontal health. This statement is supported by the peculiar way in which the tooth is suspended in its alveolus by the coiled oblique fibres of the periodontal membrane, which consist of fibrous non-elastic tissue. Vertical pressure stretches all those fibres to a very small extent and transforms the force into pull without any compression of the periodontal membrane or pressure against the bone. The opposite situation prevails in regard to the effect of lateral force. The number of principal fibres in resistance is small. Almost the whole force becomes active in a comparatively small area, the gingival and apical thirds of the periodontal membrane and the bone, in the form of pressure which results in a pathologic condition—periodontal trauma.

The force is produced by the muscles of mastication if mandibular movements of any type are responsible, in which case it is intermittent; but the damaging force can also be the result of a lack of balance in the retentive musculature of the dentition, that is, between the tongue and the muscles of lips and cheeks. And this force is of almost continuous character.

According to Box, one must differentiate between primary, secondary, and combined periodontal trauma. Primary trauma—an abnormal load of force against normal periodontal structures; secondary trauma—a normal load of lateral force against reduced alveolar support; combined trauma—an abnormal load of force against reduced alveolar support.

One of the most important aspects of the problem is the question of how the damaging force is introduced. The voluminous literature on this problem has hardly given sufficient information in this respect. General terms, such as "excessive force" and "overload", are commonly used and give the impression that some kind of over-exercise in regard to masticatory function or occlusal disharmonies and premature contacts leading to traumatizing contacts during mastication are responsible for the existence of periodontal trauma. Occlusal disharmonies are taking quite a preponderant place in the present periodontal literature and therapy. It is interesting that the methods recommended by almost all such publications for the relief of occlusal disharmonies have been designed for the construction of artificial dentures. The principles upon which those procedures are based can certainly not be applied to the normal functional movements of the mandible. The question how premature contacts should establish themselves in spite of the fact that eruption occurs under the continuous control of functional movements has never been answered. However, bruxism and the failure of the retentive musculature are only occasionally and more or less emphatically mentioned. This demonstrates clearly how little attention has been paid to the physiology of the masticatory apparatus.

The most recent studies in this field have verified the assertion this author has made for many years that masticatory function is not responsible for periodontal trauma with the exception of some special situations which will be discussed. One must differentiate in regard to mandibular movements between masticatory cycles and non-masticatory excursions or glides, which are entirely different movements. Jankelson summarizes his work on mastication as follows: "The findings indicate that food is between the teeth at all times during chewing, tooth contact being negligible and non-functional except as a tactile warning to terminate the stroke. The evidence strongly suggests that centric occlusion is the only tooth contact of any significance that occurs during stomatognatic function. Evidence of eccentric tooth balance during eating was not found. There was no evidence that balance of teeth in eccentric is a physiologic necessity or that lack

of eccentric balance is less conducive to masticatory function."

These findings, and also the fact that there is no type of malocclusion which necessarily produces periodontal trauma and that periodontal trauma can be manifest in cases which present almost ideal occlusal conditions, make it obvious that occlusion is only in certain specific situations a factor of primary importance. Otherwise, it may be a predisposing factor and it also can be immaterial in regard to the presence of periodontal trauma.

Many years of clinical observation have resulted in the following arrangement of the different types in which the lateral force is introduced which produces periodontal trauma.

Type I. Injurious lateral force can be produced in the case of an abnormal axial inclination of teeth which may derive:

(*a*) from bucco-lingual occlusion in the molar and bicuspid area, (*b*) due to the loss and non-replacement of teeth which leads to tipping, drifting, and elevation of the antagonist. Conditions of this type are abundantly described and evaluated in periodontal literature.

Type II. Overbite without overjet in which anterior teeth make contact before centric occlusion is established so that displacement of the teeth attacked takes place. It is evident that intermaxillary relationship of this type could not have existed originally, consequently a change in the position of either the occluding elements or of the mandible as a whole must have occurred.

Type III. Bruxism, nightly mandibular excursions under more or less considerable stress, seems to be one of the most important avenues for the initiation of periodontal trauma, primary as well as secondary.

Type IV. Lack of balance between a powerful over-sized tongue and soft and toneless muscles of lips and cheeks. This type of periodontal trauma is predominantly found in the teen-age group very soon after the dentition has completed its eruption. In cases of this type the traumatizing lateral force is practically continuous. The anterior teeth involved are moved out of position and the destructive progress is extremely rapid.

The effect of periodontal trauma has been studied on evidence found in material obtained in animal experiments and in human autopsy material. Experimental work upon which the effect of periodontal trauma is described cannot be considered as offering conclusive evidence since the experiments carried out have only demonstrated the effect of:—

(1) Suddenly increased vertical stress;

(2) Slight continuous orthodontic pressure; and

(3) Heavy continuous orthodontic pressure.

Therefore, the findings of these experiments are by no means applicable to the clinical phenomenon of periodontal trauma.

The traumatizing forces are predominantly intermittent. Consequently, the tooth, after having received the injurious attack, always returns into its previous position if the mandible returns into the physiologic rest position.

In order to get information about the effect of intermittent lateral force which derives from the individual's own musculature the following experiment was carried out:—

Two Rhesus monkeys were used because their dentition has the closest similarity to the human dentition. The basic idea was to try to imitate the situation which exists in cases of deep overbite where initial contact is made in the incisor region. Onlays were placed on the two central incisors which elongated the incisal edge about 7 mm. Within two weeks those two incisors moved labially, formed a diastema, and became very markedly loose. After a period of one month one of the monkeys was disposed of and the other one was relieved of the incisal attachment and the shape of the tooth restored to normal. Two weeks later the teeth were solid. They did not, however, return to their previous position. The histological findings of this case are quite interesting and turned out to be exactly what was expected. In slides here presented you see lateral resorption of the bone and resorption of the cementum, while the periodontal membrane has changed its organized structure and is converted into non-organized fibrous tissue with heavy round cell infiltration. The next two slides, which are taken from Häupl and

Lang's (1928) *Marginale Periodontitis*, illustrating the effect of traumatic occlusion in human autopsy material, show exactly the same findings. The question whether trauma is able to produce periodontal pockets is still unsolved and cannot be decided upon because the period of time which has been used by myself and in the latest experiment carried out by Glickman is much too short to be conclusive and we have not yet been able to extend a similar experiment as just described over a period of at least twelve months or more.

After having discussed the quality and quantity of the force creating periodontal trauma, the different ways of its introduction and its effect, the point has been reached where the proper means of its elimination should be analysed.

The therapeutic measures instituted for the relief of occlusal trauma differ correspondingly from the four different types which indicate the source and introduction of the damaging force.

In regard to Type I, where the malposition of the individual teeth is responsible, orthodontic treatment alone will result in perfect relief. If orthodontic treatment cannot be applied, elimination of lateral force by grinding will bring some improvement and should be carried out without reducing the vertical dimension. The reconstruction of contact points by restorations is, of course, a measure which is self-evident. If some teeth have suffered considerable loss of alveolar bone due to malposition or loss of contact, the only way to prolong their life is the construction of a fixed splint, which unites at least three adjacent teeth to one solid unit by construction of MCD inlays or three-quarter crowns which are rigidly connected.

In cases of the second type, where overbite without overjet is the necessary pre-requisite for the existence of periodontal trauma, it is understood that no permanent improvement or cure can be accomplished if the overbite is not reduced to such extent that masticatory action is possible without contact in the anterior region. This fact has been recognized and grinding as well as the raising of the bite has been recommended. But neither grinding nor the creation of a new plane of occlusion by the construction of crowns and inlays or by splints is the solution of the problem for two reasons: first—the elongation of the clinical crown increases the leverage and is definitely contra-indicated since it is known that the crown should be as short as possible in relation to the length of the root. The other unfavourable aspect, which also renders the results of grinding ineffective, is the fact that the anterior teeth which have lost their occlusal stop will elevate until they contact each other again and, therefore, the primary condition will be re-established after some months have elapsed.

The capacity of the tooth to elevate if it is deprived of its occlusal stop has brought an appliance into the picture which utilizes this unique feature and becomes a very effective instrument to raise the bite of the patient without elongation of the clinical crowns and keeps the situation which has been established in retention for an indefinite period of time. This appliance which periodontia adopts from orthodontia is the bite plate. The bite plate is a horseshoe-shaped plate made of acrylic which does not need any retentive attachments, only two short handles to remove the appliance from the mouth. An anterior wire which secures the stability of the anterior teeth is a valuable but not essential adjunct, and if more retention is desired arrow clasps may be attached. From cuspid to cuspid there is the bite wall which should articulate with the lower six anterior teeth in such a way that they hit the bite plate at an angle of exactly 90° so that vertical force only will be exerted. The height of the bite plate should be such that some of the freeway space, about $1\frac{1}{2}$ to 2 mm., should still be available and may allow the patient to move into physiologic rest position and be without any strain. The effect of the bite plate consists in the elevation of the molars and bicuspids. It has to be worn day and night for a period of four to six months, and is removed only during meals for mastication and for cleansing purposes. After some time has elapsed, the molars and later on the bicuspids will occlude while there is free space between the upper and lower incisors and cuspids. The limit to which the bite should be raised will

have been reached when the normal masticatory excursions can be performed without injurious contact in the anterior region. The result thus obtained requires retention since otherwise the anterior teeth would elevate and the primary condition would be re-established. The bite plate itself is the proper appliance for this retention and has to be worn at night only in order to accomplish this purpose. An excellent illustration of the effect of the bite plate is the photographs of the study cast of a lower arch before and after treatment which show elevation of molars and bicuspids without elongation of the clinical crown. The curve of Spee has flattened considerably.

To illustrate the clinical effect of this method of treatment a short case report may be presented. The case concerns a woman, 24 years of age, who has been suffering from progressive loosening of the four upper incisor teeth for two years. The condition was diagnosed as periodontosis and various treatments were applied, without evidence of success. The patient presented a complete dentition. There was hardly any deposition of calculus, and a Class I malocclusion was present, consisting of crowding of the anterior teeth and moderately deep overbite. The gingival tissue did not show any acute inflammation, but suppurating pockets 5 to 6 mm. deep were present on the labial and lingual sides of the upper incisors. The central incisors presented a considerable and the lateral incisors a lesser degree of mobility. The roentgenogram revealed vertical alveolar resorption around the central and lateral incisors where the bone was reduced to almost a third of its original height. The rest of the dentition showed very little evidence of active periodontal disease. During masticatory movements the incisors were pushed out of their position. The case represents a typical picture in which the physiologic forward movement of the mandible is blocked by deep overbite which results in the trauma of the incisor teeth which receive an excessive amount of lateral stress during mastication and in centric occlusion. After symptomatic treatment, which consisted of pocket elimination, the patient was equipped with a bite plate and wore the appliance for a period of five months, day and night, except during meals and during cleansing periods. Within this time the molars and bicuspids elevated to such extent that the bite was opened 2 mm. in the incisor region, and mandibular movements of any extent did not result in contact between the lower and upper anterior teeth. At the time when the proper relation of the anterior teeth was established the condition of all the teeth was somewhat improved. During the following year the condition improved markedly and has stayed at the same level for a period of over fourteen years.

The question whether lack of contact in the anterior region corresponds to the requirements of the ideal occlusion has to be answered affirmatively, since it is frequently found in cases of ideal occlusion. The tongue position during physiologic rest on top of the lower incisors prevents these teeth from elevation into contact and represents, therefore, some kind of a bite plate provided by nature.

The third type in which the nightly activity of the mandible is responsible for the periodontal involvement has been subject to appliance therapy for more than five decades.

The most effective and satisfactory appliance for the elimination of bruxism seems to be the bite plate, which is worn for this purpose at night only. The advantage of this appliance compared with any other one used lies in the fact that all molars and bicuspids are completely at rest. They are all out of occlusion while the lower anterior front teeth receive an amount of vertical stress which proves to be very stimulating and beneficial for their periodontal health even in cases where these teeth have suffered considerable loss of alveolar bone. The effect of this appliance is quite spectacular in regard to the mobility of the teeth, which subside to a great extent within a surprisingly short time. In order to illustrate the effectiveness of this therapeutic measure the following case is briefly presented: In February, 1948, a woman, 48 years of age, was presented for consultation by a dentist. There was considerable mobility in the molar and bicuspid regions and the dentist thought about 8 teeth should be extracted. Examination revealed a relatively very good occlusion, definitely above

average. It did not give any clue to the existence of the deep vertical bone resorption in the right and left upper molar and bicuspid regions. The patient reported that she was tortured by nightmares every night and used to wake up with a tired feeling and headaches. Interrogation of the husband confirmed that the patient suffered from bruxism in an extremely high degree. The only therapy instituted was the construction of a bite plate. The dentist in charge did not attempt any other type of local treatment. The condition improved progressively. The patient's teeth became solid again and interestingly enough she did not complain about any disturbance of her sleep or about any headaches in the morning. Six years later the patient was in good condition and had no complaints. The teeth were solid and the roentgenogram showed a most interesting recovery of bone. In areas where the lamina dura was almost completely destroyed it has been perfectly re-established, which proves definitely the return of normal physiological conditions.

The results of the use of the bite plate in cases of bruxism has definitely cast some light on the whole problem because it demonstrates the beneficial effect of a measure which eliminates every occlusal contact between the molars and bicuspids during the night. From the effect thus obtained one can draw conclusions in regard to the extent of the nightly activity of the mandible and its effect. For this reason the bite plate should be used not only in cases of active bruxism to a greater extent, but also in cases where the tooth-supporting bone has been considerably reduced due to periodontitis simplex, in order to secure a period of complete rest for all teeth except the lower anterior teeth which receive beneficial stimulation. One has to visualize that repeated swallowing and the result of the different positions during sleep has definitely an effect upon the tooth-supporting structures, and if these structures are weakened it seems to be mandatory to protect them during the night from every amount of unnecessary irritation.

The treatment of cases of the fourth type where lack of balance between the muscles of the tongue and those of the lips and cheeks are causing the trauma has to be approached by entirely different means.

The problem which confronts one is: (1) to compensate for the lack of retentive power of the muscles of the lips and cheeks by providing sufficient artificial retention to balance the pressure of the tongue; (2) if teeth have been already moved out of position it will become necessary to move those teeth back into their previous normal position in order to correct their axial inclination; (3) muscle exercises have to be instituted in order to strengthen the weak muscles of lips and cheeks to such an extent that finally the patient will not need continuous retentive apparatus. Those procedures can be best described by presenting a case of this type and demonstrating the appliances used for its treatment and their effect. This case concerns an 18-year-old girl who had primarily a perfect dentition, in regard to occlusion. There was no caries or deposition of calculus. Within three years a diastema had formed in the upper anterior region and the central upper incisors, the two lower central and right lateral incisors and the left upper first molar became markedly loose. The roentgenogram showed that the three lower incisors were almost exfoliated and hopelessly involved. The upper left central incisor and the left upper first molar present extensive reduction of the alveolar bone. There is no occlusion in the upper anterior region. The tongue of the patient has been found to be extremely bulky and presented imprints of the teeth all along its margin, while lips and cheeks were flabby and without any tone. After recognizing the aetiology of the case, the following treatment was introduced.

The hopelessly involved three lower incisors were removed and appliances were constructed aiming to provide retention. Those appliances consist of acrylic horseshoe-shaped plates equipped with the following attachments: in the front there is a high labial spring wire which can be activated to exert pressure against the teeth towards the lingual; in the molar and bicuspid region there is some kind of continuous clasp, and in order to avoid any tendency of the appliance to cause expansion the appliances are split and a jack screw built

in, which makes it possible to reduce their width so that they act in a contracting manner. The same appliance was constructed for the lower arch. It should be mentioned that the upper appliance is not provided with a bite plate since there is no indication for its use. The part of the plate which borders the lingual surface of the upper central incisors is reduced in order to allow their lingual movement, which is accomplished by activating the high labial spring. It is understood that the forces used for those movements have to be extremely small, since they would otherwise produce considerable damage. The re-establishment of the normal arch form was accomplished within four months. After this period of treatment both arches were kept in passive retention.

At the beginning of the treatment, muscle exercises were introduced in order to strengthen the muscles, particularly of the lips and also of the cheeks. The patient must perform two exercises: one exercise consists of opening and closing the mouth to its maximum limits, with maximum force; the other exercise consists of contracting the mouth against resistance which is provided by two fingers which are hooked into its corners. These exercises should be done three times daily, thirty times, and increased to one hundred times each period. It is quite surprising how slowly the force of those muscles builds up. It took four full years before this patient was able to abandon the appliance during the day without presenting some extent of relapse within such a short period of time. The effect of the treatment was very satisfactory and may be illustrated best by the study cast and X-ray findings; so far, nine years after treatment was begun, the patient has not suffered any further loss of periodontal health, which seems to indicate that the approach to the problem in regard to its aetiology was correct.

For over fourteen years the theories and methods of treatment here presented have been tested in a large number of cases. The lasting success which has been observed where there was no major treatment other than the elimination of periodontal trauma seems to indicate strongly that periodontal trauma is a primary factor in chronic periodontal disease.

Root Canal Obturation

Canal enlargement, canal sterilization, and canal obturation (or filling) are given as the principles for successful root canal therapy.

Seventy-five per cent of failures are ascribed to lack of complete obturation of the root canal. The space that is left is demonstrated on extracted teeth using radio-active iodine and the radio-autograph technique.

The harm that may arise from such a space is described and an analogy made to the "opened-closed tube" experiment of Rickert.

The single point and multiple point techniques are given using gutta-percha or silver. Emphasis is placed on reaming just short of the apex in order to keep the apical opening small.

Special techniques are given for the open apex or "blunderbuss" root canal using tailor-made thick points or by gaining access to the apex surgically through a window cut in the buccal plate of the alveolus.—INGLE, J. I. (1956), *J. Amer. dent. Ass.*, **53**, 47.

A Clinical Evaluation of Xylocaine Anæsthesia

In this investigation the clinical efficiency of 2 per cent xylocaine with 1–80,000 adrenaline was compared with standard 2 per cent procaine/adrenaline in a series of 329 injections. Statistical analysis shows xylocaine to be superior to procaine in rapidity, and in depth and extent of anæsthesia, and to be of greater duration.

It was also shown to be effective in lower dosage than procaine. Based on the results obtained, the author puts forward a series of doses lower than those in general use to reduce further the danger of toxicity, and the duration of after-effects.—COWAN, A. (1956), *J. dent. Res.*, **35**, 824.

CORRIGENDUM

W. G. CROSS and I. YUKTANANDANA: "The Role of Orthodontics in Periodontal Treatment," 1957, Vol. VII, No. 12, August, p. 391. The illustrations for *Figs.* 3 and 4 should be transposed.

BRITISH SOCIETY OF PERIODONTOLOGY

ANNUAL CLINICAL MEETING, 1957

Held at the Eastman Dental Hospital, London, on April 5, 1957

TABLE DEMONSTRATIONS

A CHEMICAL CHANGE IN CERVICAL DENTINE IN PERIODONTAL DISEASE

By **R. D. EMSLIE**, M.S. (Ill.), B.D.S., F.D.S.
Guy's Hospital Dental School, London
and **M. V. STACK**, Ph.D.
Bristol University Dental School

It has been suggested (Riffle, 1951, 1953; Bass, 1951) that a change occurs in the roots of teeth affected by chronic periodontal disease. Riffle maintains that this change can be appreciated by curetting with a sharp instrument and it would appear therefore to be a change in hardness. In *Fig.* 1 is shown the typical appearance of extracted teeth which had been curetted by Riffle until he felt that sound dentine and enamel was reached (Riffle, 1954).

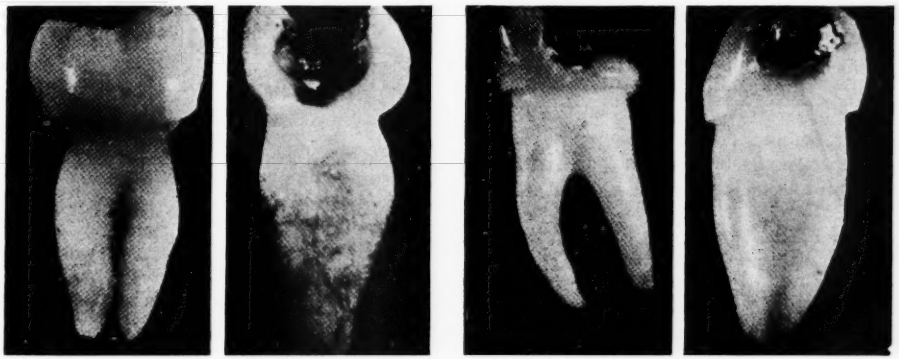

Fig. 1.—The typical appearance of extracted teeth (Riffle, 1954).

Purpose of the Investigation.—To test the hypothesis that chronic periodontal disease is associated with a chemical change in the dentine of the roots of the teeth.

Method.—Extracted teeth were kept dry, or stored in 1 per cent zephiran chloride or absolute alcohol. Curetted material and burred samples from the underlying dentine, supplied by Riffle and R. D. E., were compared by two types of analysis:—

1. Estimation of total organic content by wet combustion.

2. Estimation of total free amino-acid groupings (ninhydrin reacting substances excluding ammonia) by colorimetric analysis. This analysis includes terminal amino-acid groupings as well as free amino-acids. For this reason we refer to amino-acids in inverted commas. Dentine from later samples (supplied by R. D. E.) for analysis was prepared by pulverization.

Results.—The wet-ash determinations of the organic content of Riffle's material (classed as "diseased") are shown in *Table I.* The mean organic content for the whole group has been put at 100, and relative values calculated on this.

Allowing for a coefficient of analytical variation of over 2 per cent, it would seem that any difference in the organic content of the curetted and underlying dentine can only be slight.

The same samples were then analysed for "amino-acids", using the ninhydrin reagent. The results (*Table II*) show that in every case the values for the curetted dentine were less than those for inner dentine, the average ratio being about 4 : 5.

Teeth from another group were curetted after removal of the crowns in order to exclude any crusty or altered enamel and curetted to similar shapes, and the organic content of the scrapings was analysed. *Fig.* 2 shows that there was no correlation between the total organic content of the scrapings and the periodontal status of these teeth.

Table I.—Relative Organic Content of Dentine Samples from Curetted Teeth

Sample Number	*Relative Organic Content*		*Difference per cent*
	Outer	*Inner*	
1	94	98	4
2	101	105	4
3	107	108	1
28	104	112	8
29	91	90	−1
30	93	102	9
41	102	93	−9
42	97	94	−3
44	97	112	15
51	98	106	8
52	98	105	7
81	99	105	6
82	96	102	6
83	95	104	9
101	99	105	6
102	104	102	−2
103	103	101	−2
141	99	95	−4
142	102	104	2
143	92	97	5

Table II.—Relative "Amino-acid" Content of Dentine Samples

Sample Number	*Relative Amino-acid Content*		*Difference per cent*
	Outer	*Inner*	
1	104	125	17
2	87	104	18
3	126	150	17
28	82	108	27
29	75	100	28
30	58	74	24
41	79	96	22
42	121	136	12
44	81	91	12
51	88	119	30
52	88	104	16
81	86	110	25
82	100	114	13
83	95	122	25
101	74	107	37
102	89	106	18
103	86	100	15
141	96	118	21
142	89	114	25
143	87	111	24

after preliminary curetting to remove calculus and periodontal membrane. The apical region of the root was held in a pin vice and the root scraped until it resembled the roots of the curetted whole teeth. Teeth with deep pockets, and those with little or no pocketing, were

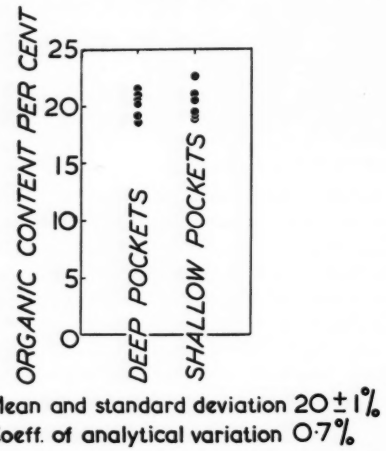

Fig. 2.—Organic content of dentine ground from cervical regions of root.

However, analyses of these samples with the ninhydrin reagent for "amino-acids" gave lower values than had been observed in the curetted whole teeth, and it was decided to examine a further series of teeth by this method.

Sections 0·5–1 mm. in thickness were cut from the cervical region of each tooth and burred to the shape shown in *Fig.* 3 in order to separate arbitrary "outer" and "inner" zones.

Fig. 3.—Transverse section of root at cervical region.

These segments were then pulverized, checking that the correct quantity of powder was recovered. Duplicate analyses were completed in batches so that corresponding

"outer" and "inner" samples were always taken together. These results are shown in *Figs.* 4 and 5 and *Table III.*

Discussion.—The actual concentrations of "amino-acids" in the pulverized samples (approx. 2·6 micromols per 100 mg.) were approximately two-thirds of those obtained from curetted and burred whole teeth, but the ratio of the values for outer and inner dentine appear to be twice as large as in the controls. The age distributions were very similar, and it was noted that the presence of caries in other parts of the tooth did not appear to affect the analyses significantly. From the last table it can be seen that the mean "amino-acid" content of the inner dentine of the controls is slightly lower than that of the periodontal disease group, but this is not statistically significant. However, if we use the "t" test to compare the mean values for the outer dentine of both groups we get a P value of between 2 and 5 per cent. In other words, the differences in "amino-acid" content of the outer cervical dentine of the

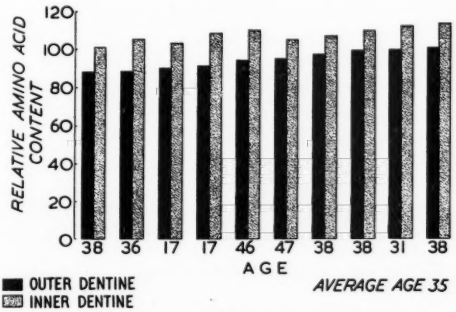

Fig. 4.—"Amino-acid" analyses of cervical dentine of teeth extracted from *healthy* periodontal tissues.

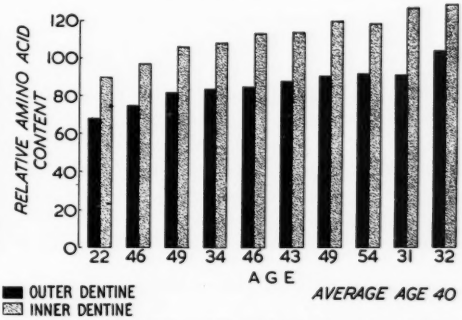

Fig. 5.—"Amino-acid" analyses of cervical dentine of teeth extracted from *advanced periodontal disease.*

Table III.—Comparison of "Amino-acid" Content of Cervical Dentine from "Periodontal Disease" and Normal Groups

Periodontal Disease					Normal				
Age	*Tooth*	*Relative Amino-acid Content*		*Difference*	*Age*	*Tooth*	*Relative Amino-acid Content*		*Difference*
		Outer	*Inner*	*per cent*			*Outer*	*Inner*	*per cent*
49	7	91	120	27	36	3	88	105	17
43	8	88	114	26	46	1	94	110	16
49	7	82	106	26	38	3	101	114	13
34	6	84	108	25	38	2	99	110	11
32	3	104	129	22	17	5	90	103	13
31	6	92	127	31	17	4	91	108	17
46	5	75	97	25	38	7	88	101	14
54	1	92	119	26	31	8	100	112	11
22	7	68	90	27	47	6	95	105	10
46	1	85	113	28	38	4	97	107	10
40		86·1	112·3	26	35		94·3	107·5	13

The mean for all values in the first group was 2 per cent different from that in the second group, and the overall coefficient of analytical variation was 1 per cent.

of the periodontal disease group was again roughly 4 : 5. Possibly some protein breakdown had occurred during the grinding procedures in the earlier experiments. The *differences* between the values for outer and inner dentine in the periodontal disease group

"periodontal disease" and normal groups are statistically, but not highly, significant. The difference in the ratios of the "amino-acid" content of outer and inner dentine of the normal and periodontal disease groups appears to be highly significant ($t = 10$).

These results are surprising in that if protein breakdown were occurring in the peripheral dentine of the roots of teeth with periodontal disease one might expect a higher rather than a lower "amino-acid" content. To get this change in its true perspective it must be appreciated that this fraction represents only 1–2 per cent of the total organic content of the dentine.

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THE STAPLE-TYPE OF FIXED SPLINT

By **J. HARRINGTON**, B.D.S., L.D.S.
Turner Dental School, Manchester

This method of splinting is applicable especially to upper anterior teeth when the æsthetic factor is important and no raising of the bite permissible. It is relatively simple to construct and does not involve the cutting of much tooth substance.

The stages of construction are as follows:—

1. Class III cavities are prepared in the teeth to be incorporated in the splint.

2. In the gingival floor of each cavity a pin-hole, 3 mm. deep, and capable of taking a 0·45-mm. diameter wire, is sunk. The pair of pin-holes adjacent to one interdental space should be approximately parallel.

3. The two free arms of a rectangular U-shaped "staple" of 0·45-mm. stainless steel wire are bent to fit into the pin-holes and roughened.

4. The staple is cemented into the pin-holes, ensuring that the cross-bar does not touch the cavo-surface angle of either cavity, and the cavity is lined in the same process.

5. The restoration of the two adjacent Class III cavities is completed in self-curing resin, and polished.

Each interdental space with its pair of Class III cavities and staple is treated in a similar way.

PERIODONTAL SPLINT

By **J. S. McKENZIE**, L.D.S.
Turner Dental School, Manchester

Individual perforating screws are used to secure loose anterior teeth to a cast lingual backing (*Fig.* 6).

Technique.—The tooth is penetrated between the amelodentinal junction and the pulp with a ½-round bur, followed by a ½-fissure bur, the diameter corresponding to that of gauge A round gold wire.

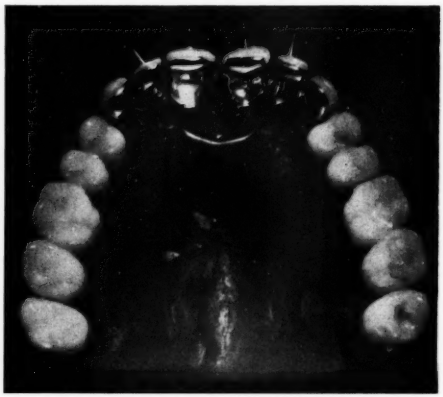

Fig. 6.—Showing cast backing held in place by perforating pins.

Short lengths of round gold wire are threaded for about ¼ inch with a die size 14 BA.

Some preparation of the teeth is desirable to provide fitting margins for the casting.

An impression taken of the fitting surface is withdrawn lingually.

The casting is fitted to the teeth and while held in position, the backings are first perforated by a ½-round bur, followed by a hand twist drill in a broach holder. The holes are then threaded by a tap (size 14 BA).

The backing is cemented into position and secured by the perforating pins dipped into a thin mix of cement and screwed into place with the aid of a broach holder.

The extruded ends of the screws are cut off and labial ends may be drilled out sufficiently to allow an acrylic facing to cover the gold screw.

Advantages.—This permanent fixed splint is simple to construct and avoids the difficulty of parallel pins in mobile teeth which have previously been used in this type of splint.

SEASONAL INCIDENCE OF ACUTE ULCERATIVE GINGIVITIS

By **J. A. PEDLER**, M.D.S., F.D.S., L.R.C.P., M.R.C.S., and **B. G. RADDEN**, B.D.Sc., F.D.S.
The London Hospital Dental School

A seasonal variation in the incidence of Vincent's acute ulcerative gingivitis has been reported. It has been shown that the lowest incidence is found during the summer months and there is an increase from about October to reach a peak in December and January (Stones, 1954). The poor summer of 1956 prompted an investigation to determine whether the unusual climatic conditions could be correlated with a variation in the established pattern of incidence of the disease.

The demonstration consisted of a series of charts compiled from data relating to 203 cases of acute ulcerative gingivitis attending the Parodontal Clinic of the London Hospital between January, 1956, and March, 1957. Information was recorded on transcription sheets, punched on a 65-column Powers-Samas system and machine-sorted. A composite graph was prepared showing both the monthly incidence of acute ulcerative gingivitis and inverted graphs of the monthly hours of sunshine and the mean maximum/minimum temperatures as recorded by the Air Ministry Meteorological Office. The official average sunshine and temperature values were also charted.

In this series the monthly incidence was highest in the winter from November to February and there was a comparatively low incidence in May and June. May was the only month which had sunshine and temperature records above average. For the remainder of the summer months sunshine and temperature values were well below average. The composite graph served to illustrate an apparent correlation between climatic conditions and the incidence of acute ulcerative gingivitis.

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CALCULUS AND WEAR IN THE TEETH OF SIXTH CENTURY JUTES

By **D. C. A. PICTON**, B.D.S. (Lond.), F.D.S. R.C.S. (Eng.)
Registrar in the Department of Preventive Dentistry, Guy's Hospital

Twelve jaws and fragments of skulls from the Lyminge collection were shown, details of which appeared in the DENTAL PRACTITIONER (1957, **7**, No. 10, June, 301). The demonstration illustrated the character and wide distribution of calculus and the varying degrees of attrition.

Many of the teeth had small deposits of calculus and in 2 cases gross tartar was evident around unopposed teeth from individuals of over middle age. All the jaws shown had sound interdental bone, except one mandible from which the posterior teeth had been lost long before death and the incisor apices only were covered by bone.

In the teeth of a nine-year-old child, wear of the permanent dentition was restricted to the first molars, while two adult jaws had gross attrition to the extent of pulp exposure and subtotal loss of the first molar crowns. Progressive loss of lower buccal and upper palatal cusps could be traced over the age range.

Several examples of caries and mild orthodontic irregularities were also demonstrated.

SOME OF THE LESS COMMON PERIODONTAL LESIONS

By **A. BRYAN WADE**, B.Ch.D., F.D.S. R.C.S.
Director, Department of Periodontology, Royal Dental Hospital of London School of Dental Surgery, University of London

Simple inflammation is by far the commonest type of lesion affecting the more superficial parts of the periodontium. Of the less common lesions examples are shown of Sjögren's syndrome (Thonard, 1956); erosive lichen

planus; gingivosis associated with post-partum amenorrhœa, menorrhagia, hysterectomy and öophorectomy, and post-menopause (Trott, 1956 a, b); moniliasis in a healthy young adult (Trott, 1955); acquired hyperkeratosis and acute monocytic leukæmia. Where indicated these cases have already been reported in the literature. The case of acute monocytic leukæmia will be presented in detail owing to the rising incidence of leukæmia from 17 per million in 1931 to 40 per million in 1954 in British people (Court-Brown and Doll, 1957).

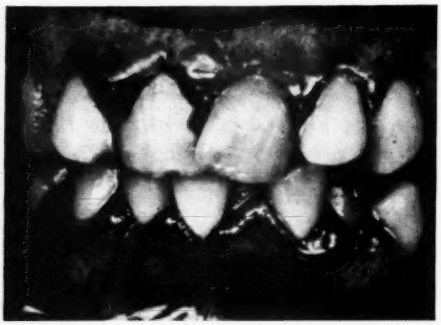

Fig. 7.—Anterior view showing extent of gingival enlargement, detached papillæ, and areas of desquamated epithelial cells mainly in the maxilla.

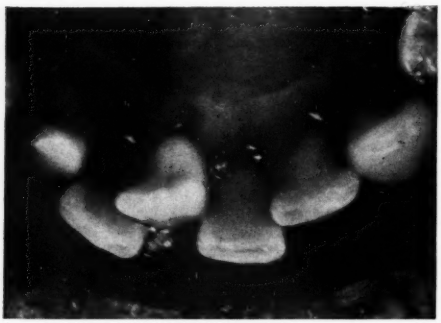

Fig. 8.—Ecchymoses lingually between $\overline{43|}$, $\overline{21|}$ and $|\overline{234}$. (Mirror image.)

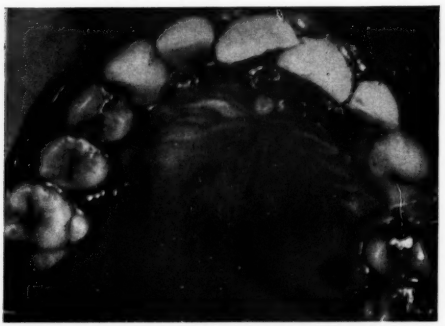

Fig. 9.—Necrosis of marginal gingivæ palatal to $\underline{21|1}$ with ecchymosis between $|\underline{56}$. (Mirror image.)

Case of Acute Monocytic Leukæmia

The patient was an unmarried female, aged 34, of high educational standard, possessing a Master of Arts degree, working as a cashier and living alone in a bed-sitting room.

She first presented complaining of sore, bleeding gums of 3 days' duration together with a headache and feeling "off colour". On examination the gingivæ were maroon coloured, swollen, and tender, with some ulceration of the margins. A marked halitosis was present. The condition was diagnosed as Vincent's infection; chromic acid and hydrogen peroxide were applied to the gingival margins, penicillin troches were prescribed, and the patient advised to return in 48 hours. This she did and the present writer was asked to see her.

No improvement had occurred. There was still the complaint of sore and bleeding gums. The headache was now of 10 days' duration, having been accompanied by body pains and been diagnosed as influenza by the patient's general medical adviser. In spite of this she had continued to work and, having climbed to the fifth floor of the Hospital, did not complain of fatigue or loss of breath.

Physically, she was of average height and weight and had a well-balanced diet. Her complexion was pale and the skin of her hands was slightly cyanosed. Hæmatomata approximately 6×6 cm. were present on the left elbow and ankle, the patient having no recollection of injuring these regions.

There was an exceedingly foul odour emanating from the oral cavity which was not like that characteristic of a Vincent's infection, but definitely smelt of decaying tissue.

Examination of the oral cavity revealed only slight enlargement of the gingival margins with rounding of the interdental papillæ, some of which were detached, their surfaces being shiny and demonstrating pitting. The colour on the vestibular aspect in the maxilla was purplish-red and in the mandible more dusky red. Desquamated epithelial cells were still lying on the surface of the attached gingivæ in the maxilla (*Fig.* 7). Lingually and palatally maroon-coloured ecchymoses were present in the marginal gingivæ in several regions, that extending from $\underline{2|1}$ undergoing obvious breakdown changes with tissue necrosis (*Figs.* 8, 9). No marginal ulceration of the Vincent's type was detected.

Hæmatological examination revealed the following figures:—

Hæmoglobin	76 per cent = 11·6 g. per 100 ml.
R.B.C.	4·0 million per c.mm.
Colour Index	0·9
Leucocytes	50,000 per c.mm.
Polymorphs	5,000 per c.mm. = 10 per cent
Lymphocytes	2,5000 per c.mm. = 5 per cent

Monocytes	22,500 per c.mm. = 45 per cent
Monoblasts	19,000 per c.mm. = 38 per cent
Myelocytes	1,000 per c.mm. = 2 per cent

One nucleated red cell seen in counting.

These findings enabled a diagnosis of acute monocytic leukæmia to be made.

Arrangements were made for admission to hospital, but 24 hours after being seen by the present writer, she was found in an unconscious state, with her face covered in blood. Death ensued in a further three hours.

Hæmatological examination two hours before death revealed:—

Hæmoglobin	73 per cent = 10·8 g. per 100 ml.
Leucocytes	39,700 per c.mm.
Polymorphs	9 per cent
Lymphocytes	4 per cent
Monocyte series	87 per cent
Monoblasts	7 per cent
Promonocytes	70 per cent (atypical)
Monocytes	10 per cent

Three normoblasts seen in 300 cells counted.

Platelets very scanty in number, with little or no granulation.

Sternal marrow aspiration performed at the same time produced the following report: "This shows diffuse infiltration by an acute blast cell leukæmic process. There is an associated absolute depression of red-cell formation and of megakaryocytes. This is coupled with a peripheral thrombocytopenia.

"The type cells are best shown in the peripheral stream and most closely resemble monocytes of varying degrees of maturity. Interspersed, there is a small number of myeloid granulocyte precursors. The picture is that of an acute monocytic leukæmia—the Naegeli (1931) type of myelogenous leukæmia."

Post-mortem examination showed numerous petechial hæmorrhages and ecchymoses. The two hæmatomata observed at clinical examination had faded appreciably. A recent hæmorrhage had destroyed most of the right temporal lobe and adjacent parts of the basal nuclei of the brain and similar hæmorrhages were found in the right frontal lobe and anterior perforated space. Extensive hæmorrhage had occurred in the vagina and many smaller ones in the liver, tongue, œsophagus, gastric mucosa, and kidneys. The spleen showed only slight enlargement, weighing 300 g. It was firm in consistency, homogenous in appearance, and browny-red in colour. The bone-marrow of the femur was hyperactive for three-quarters of the length of the bone, with one or two red active areas in the lower end. No enlargement was detected in any of the endocrine glands.

The cause of death was cerebral hæmorrhage due to acute monocytic leukæmia.

Discussion.—This case is presented in order to emphasize the great need to diagnose all oral conditions most carefully. The common complaint of sore and bleeding gums should never be dismissed flippantly, a medical history should always be taken, inquiry into dietetic habit should be made, and evidence of any general signs and symptoms of a blood dyscrasia sought.

It is often stated that the gingival necrosis found in a leukæmia may be mistaken for a simple Vincent's infection. In this case, however, the halitosis was definitely different from that often encountered in Vincent's disease and the typical saucerizing ulceration of the tips

Fig. 10.—Histological section of gingival tissue removed from $\overline{12}$ labially at autopsy. Dense infiltration of the corium by monocytic cells in varying stages of maturity, with the typical less cellular zone beneath the epithelium, can be observed. Few fibres are present in the stroma, which contains many distended capillary vessels with some monocytes within them. The epithelium shows many mitotic figures and considerable surface fragmentation, which may be due to post-mortem autolysis. (× 95.)

of the interdental papillæ, so characteristic of Vincent's condition, was not present.

The outstanding features were the maroon-coloured areas of submucosal hæmorrhage, the tissue necrosis over one of these sites, and the exceedingly foul halitosis, these being due, most probably, to the thrombocytopenia (Matheson, 1949). Gingival enlargement, regarded by many (Wentz, Anday, and Orban, 1949) as a striking feature of the monocytic leukæmia, was not very marked and was a long way from entirely covering the crowns as mentioned by Fish (1948). There seems little doubt that the gingival changes in this patient emanated mainly from within (*Fig.* 10), a response to local irritation of a tissue affected by systemic disease, as suggested by Stoy (1952).

The exceedingly rapid termination of life was also unusual.

I wish to acknowledge the help afforded me by Dr. R. Nassim, under whom the patient

was admitted to St. George's Hospital; Dr. J. L. Stafford, who performed the second hæmatological examination; and Dr. R. D. Teare, for his autopsy and report; also to Professor R. B. Lucas and his staff, who assisted me in the Royal Dental Hospital.

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THE HISTOLOGY OF A BONE IMPLANT*

By **W. G. CROSS**, M.B., M.S., B.D.S.

Department of Periodontology, Eastman Dental Clinic

DURING recent years the implantation of bone in various forms has been carried out for the purpose of restoring bone lost as a result of periodontal disease. Clinical findings have been satisfactory in many cases, but histological appearances have not hitherto been demonstrated, and this is the reason for the presentation of this case.

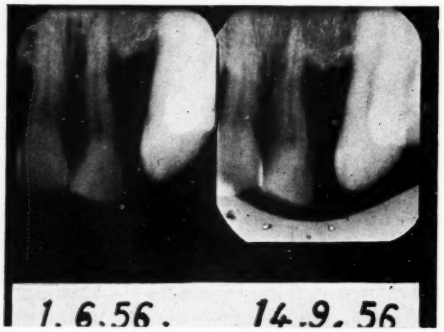

Fig. 1.—Radiographs show implanted area before and 3½ months after operation.

The patient, a male aged 51 years, had a chronic periodontitis involving many teeth, and necessitating extractions of several, including $\underline{|2}$. Pockets were present around many teeth: $\underline{|1}$ distal 10 mm., $\underline{|3}$ mesial 9 mm. It was demonstrated by Hirschfeld calibrated points that these pockets were intrabony only to the extent of 2 mm. each.

On June 1, 1956, a bone implant, using homogenous bone chips from a bone bank, was inserted after a muco-periosteal flap had been raised. The mobility of $\underline{|1}$ was such that a doubtful prognosis had to be given, but the patient was anxious to save this tooth if possible. Three months later on re-examination some pus was found to be exuding distally to $\underline{|1}$ and the tooth exhibited increased mobility. As a result, it was decided to extract the tooth (Sept. 4) together with the interdental papilla and subjacent bone, in order to assess the condition of the implant. Radiographs were taken and may be compared with the original ones (*Fig.* 1). There had clearly been little attachment of the connective tissues to $\underline{|1}$, and the tooth itself was found, on histological examination, to be dead. This probably accounted for the failure of reattachment and for the discharge of pus distal to $\underline{|1}$ noticed clinically.

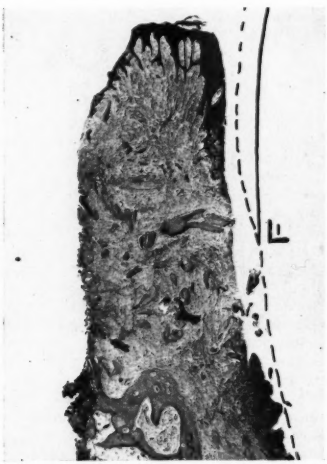

Fig. 2.—Low-power photomicrograph of gingivæ and portion of alveolus distal to $\underline{|1}$. Note numerous implanted fragments above alveolar crest.

* A casual communication given to the British Society of Periodontology at a meeting held on Feb. 18, 1957.

PATHOLOGICAL REPORT.—The pathologist's report on the resected interdental tissue is as follows :—

Fig. 3.—Fragments of implanted bone with some new bone formation taking place around them. (× 90.)

Macroscopical: A roughly rectangular mass of interdental tissue, height 12 mm. labiopalatal, width 7 mm. mesiodistal, thickness up to 5 mm. The superficial aspect is covered by interdental papillæ. The mesial aspect is grooved to accept the root of the incisor.

Microscopical (*Figs.* 2, 3): The implanted fragments of lamellar bone are lying in dense and mainly inactive fibrous tissue. In some places a little irregular woven bone has been formed, sometimes on the surface of a fragment of implanted bone, sometimes between the implanted fragments. One of the most striking features of the specimen is the absence of osteoclastic activity; no osteoclasts are now present and there is little evidence of past resorption. The field of the implant is free from inflammatory cells, but there is a moderate degree of lymphocytic and plasma-cell infiltration near the pocket epithelium.

Summary.—A case is presented illustrating the fate of a homogenous bone implant $3\frac{1}{2}$ months after insertion. Although in this case reattachment has not occurred, probably owing to the death and subsequent suppuration from the pulp of the tooth principally concerned, there was no inflammation in the actual field of the implant and in some areas new irregular woven bone had formed, sometimes on the surface of, and sometimes between, fragments of the implant.

Reaction of Odontoblasts to Medicaments placed in Cavity Preparations

The effects on the odontoblasts of numerous medicaments which are often used for cavity sterilization were studied using rat incisors. A review of the relevant literature is given.

The procedure of anæsthesia, cavity preparation, and application of the medicaments is described in detail. For purposes of analysis note was made of the calcio-traumatic reaction in the dentine and of the type of post-operative calcification. Distinct subdivisions of these reactions are accurately described for this assessment.

Results showed: (1) that orthophosphoric acid and silver nitrate both caused severe reactions in shallow cavities and pulpal destruction in deep ones; (2) that phenol produced a moderately acute reaction in medium depth cavities and severe injury to the odontoblasts in a deep one, though there was no penetration to the pulp itself; (3) that alcohol 95 per cent and sodium fluoride 4 per cent caused odontoblast injury in a deep cavity; (4) eugenol, thymol, eucalyptol, beechwood creosote, chloroform, acrylic monomer, and hydrogen peroxide produced little or no injury when applied even in deep cavities for up to 10 minutes.—PERREAULT, J. G., MASSLER, M., and SCHOUR, I. (1956), *J. Amer. dent. Ass.*, **52**, 533.

Dental Extraction in Hæmophilia and Christmas Disease

A summary of ten patients in whom 57 teeth were extracted is given which brings out the following important points:—

1. Only one or two teeth should be extracted at any one operation.

2. Oral antibiotic therapy was given for five days, starting on the day of the operation.

3. Extractions were better done under infiltration anæsthesia.

4. A protective splint was prepared before the operation and inserted immediately after removal of teeth and left in position for about 2 weeks.

5. Fresh frozen plasma was adopted as a routine form of replacement therapy for deficiency of antihæmophilic globin and was given two pints at a time just before extractions and repeated if bleeding resumed.—ORR, J. A., and DOUGLAS, A. S. (1957), *Brit. med. J.*, **1**, 1035.

SURGICAL ASSISTANCE FOR THE ERUPTION OF FOUR ANTERIOR MAXILLARY TEETH*

By **WILLIAM G. BROWNE**, H.D.D., F.D.S. (Edin.)
Glasgow Dental Hospital and School

THE patient, a boy of 9 years, was referred to Glasgow Dental Hospital because of failure of eruption of the anterior maxillary teeth.

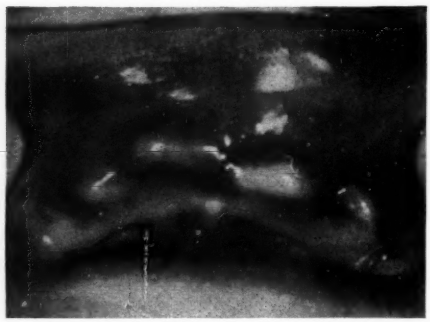

Fig. 1.—The outlines of the maxillary incisor teeth can be seen clearly. Note the low attachment of the labial mucous membrane.

Fig. 2.—Clinical appearance some three weeks following surgical readjustment of the level of attachment of the lining mucosa.

The four first permanent molars, the four lower incisors, and right maxillary canine were present and on reflection of the upper lip the outlines of four anterior maxillary teeth were seen and could be felt under the labial mucosa which was attached just in front of the alveolar crest (*Fig.* 1).

Judged by the relationship of the molar teeth the occlusion was that of Angle Class I.

There was no family history. The child was full-term and delivery was normal. Facial appearance was normal except for a slight flattening of the upper lip. The deciduous teeth had been shed naturally in the affected area.

Radiographs showed no pathological condition of the unerupted teeth and no supernumerary teeth to be present.

As the crowns of the unerupted teeth were lying labially to the alveolar crest, it was decided to sever the attachment of the lip from the palatal aspect. This was carried out under local anæsthesia on Nov. 11, 1956, and on reflection of the tissue the teeth were exposed. The attachment of the lip was secured with black-silk sutures high up on the labial aspect of the maxilla. The appearance of the clinical crowns was normal.

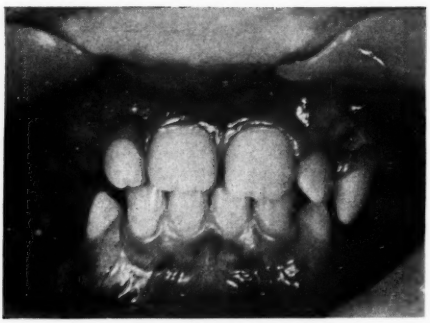

Fig. 3.—This shows the result some four months after the operation.

No orthodontic treatment was thought to be necessary, the pressure of the orbicularis oris muscle being considered sufficient to cause lingual movement of the teeth.

Fig. 2 shows the clinical appearance on Dec. 6, 1956, and *Fig.* 3 on Feb. 26, 1957, i.e., 15 weeks later.

* A casual communication given to the Glasgow Odontological Society on March 19, 1957.

ABSTRACTS FROM OTHER JOURNALS

Silver Nitrate Treatment of Proximal Caries in Primary Molars

Ninety-five children of both sexes between the ages of 7–9 years were selected for this study. All had bilateral proximal caries in deciduous molars. It was considered that at the late stage of development reached in their primary dentitions, time-consuming restorations were not justified.

Unsupported enamel and soft dentine were removed with hand instruments, and the cavity edges smoothed with disks, and made to slope towards the occlusal surface to render the preparation self-cleansing. To minimize drifting, every effort was made to maintain contact with the adjacent tooth at the cervical margin.

The teeth were isolated with cotton-wool rolls, dried with alcohol and air, and then a pledget of wet cotton-wool was dipped into finely powdered silver nitrate and transferred to the prepared cavity surface. After one minute this was removed and eugenol was applied to the exposed dentinal surface until it was stained black. The teeth of the other side were treated similarly, except that no silver nitrate was used.

Caries was considered arrested when exposed dentine was hardened and had a burnished appearance.

After one year, 111 of 136 teeth treated with silver nitrate showed arrested caries, as compared with 16 of the 93 controls.

The authors consider that removal of carious material and the formation of a self-cleansing area is essential to the success of silver nitrate treatment.—SCHULTZ-HANDT, S., TAYLOR, R., and BRUDEVOLD, F. (1956), *J. Dent. Child.*, **23**, 184.

The Limitations of a Calculus-preventing Agent

Previous substances for preventing the deposition of calculus are commented upon and a report is presented of the use, by the author on himself, of *Extar* in preventing the deposition of supragingival calculus. Two months after using *Extar* solution morning and evening no apparent calculus was present, even though previously scaling had been necessary every 3–4 weeks. More careful examination after the application of a rubber dam did, however, reveal calculus on the proximal aspects of the teeth. Cessation of the use of *Extar* revealed, after a further period of two months, a quite obvious deposition of calculus.

It is concluded, therefore, that this material is effective in preventing the deposition of calculus in areas which can be mechanically cleansed by the toothbrush, but warning is given against the danger of patients ignoring the need for scaling of proximal aspects and subgingivally, whilst it is admitted that no evidence has yet been produced to show the safety of this agent in relation to the tooth or the soft tissues—THOMAS, B. O. A. (1956), *J. Periodont.*, **27**, 314.

Cancer of the Tongue

The age incidence is highest between 50 and 70 years and average age is about 62 years. The ratio of male to female patients is 2 to 1. Growths can be proliferative, ulcerative, or infiltrative, the first being more radio-sensitive. The majority of cases were squamous carcinomas. It is a fair statement that in this country to-day the commonest ulcer of the tongue is cancer; other cases that may confuse the diagnosis of cancer are dental and traumatic ulcers, gumma, tuberculosis, infection around a foreign body, and actinomycosis. The biopsy should be carried out preferably at the place of treatment. The biopsy results can be confused with that of the papilloma and the warty or fissured lesion of chronic superficial glossitis. The main method of treatment in lesions of the anterior two-thirds of the tongue has been implantation of radium. This treatment is safe and quick and a high dose can be given with minimal tissue damage, also the function of the tongue is better restored. Teletherapy became the method of choice in lesions of the posterior or pharyngeal portion of the tongue.

Excisional surgery, either radical or palliative, was reserved for primary resistant and recurrent cases.—CADE, SIR STANFORD, and LEE, E. STANLEY (1957), *Brit. J. Surg.*, **44**, 187.

Surgical Approach to Immediate Denture Æsthetics

A technique of surgical preparation is described in which the soft tissues over the area of intervention are completely removed. The bone is left exposed under the denture. The technique is recommended as a means of minimizing the quantity of bone removed, in that no space is to be created within the anterior flange to accommodate the covering soft tissues.—WAGMAN, S. S. (1957), *J. pros. Dent.*, **7**, 43.

Scientific Approach to the Study of the Temporomandibular Joint and its Relation to Occlusal Disharmony

A description is given of the dissection to expose the joint capsule from above by removal of bone from within the skull outward. In centric occlusion the capsule is seen to be lax. In assumed rest position the capsule becomes taut. By similar techniques the intra-articular disk is exposed. The movement of the disk appeared to be very much less than originally described, the most notable observation being that of the marked change in contour of the disk as the condyle moved. Perforations in the disk as the cause of temporomandibular joint disorders are discounted. It is considered that such disorders are associated with occlusal disharmonies of various types as well as periodontoclasia.—LANDER, J. S. (1957), *J. pros. Dent.*, **7**, 170.

A Report of the Resin Composition Capable of Bonding to Human Dentine Surfaces

The authors describe an acrylic resin mixture that bonds strongly to "wet" surfaces of teeth *in vivo*.

The definition of "wet" specimens is teeth that have been stored in water and dried with absorbent material and air. The material consisted of the following mixture: sevriton cavity seal, methylmethacrylate polymer, plus 2 per cent benzoyl peroxide, methylmethacrylate monomer, and sevriton catalyst.

The mixture was placed on the dentine surface, acting as an adhesion between the tooth and the acrylic mix proper. The bond effected showed good resistance to water immersion. Prior etching with acid increased the strength of the bond. It is suggested that the bonding is due to clinical combination between one of the constituents of the organic matter of the denture.—BUONOCORE, M., WILEMAN, WILLIAM, and BRUDEVOLD, FINN (1956), *J. dent. Res.*, **35**, 846.

COURSES FOR DENTAL TECHNICIANS

DENTAL Technicians' Committee, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1. Evening Courses for Dental Technicians in Crown and Bridgework, Orthodontics, and Full and Partial Dentures, including Immediates and Chrome Cobalt, will be held, commencing in October, 1957. Each course will consist of twelve sessions which will be held fortnightly. The courses will be of an advanced nature and are primarily intended for adult technicians.

Further particulars and application forms may be obtained from the Honorary Secretary, Dental Technicians' Committee, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1.

DENTAL RADIOGRAPHY

A two-day course in dental radiography has been arranged for dental nurses and assistants, to take place on Thursday and Friday, October 17–18, 1957, at the Ilford Limited Department of Radiography and Medical Photography, Tavistock House North, Tavistock Square, London, W.C.1.

No fee is charged for this course. Application forms will be sent on request.